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A PROPOSAL FOR A FAST(ER) SWITCH FOR SLOW CYCLING FLUX PUMPS

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1) Runs on the first version of the flux pump switch (ref. 1) indicated that it was cooled too well and that it was only partially normal during operation.

2) The Mark II cup design (ref. 2 & 3) seemed to be efficient but required a long cooling time, up to 100 seconds, when driven at high voltage.

3) Adding a #55 drill hole to the top of the switch cup seemed to improve recovery time, but now the switch again seems to be only partially normal.

The following scheme is therefore proposed (figure 1):

1) Heater (H_1) drives cryotron switch (S) normal as in previous schemes. Liberated gas drives the fluid from the restricted bottom opening (V) of the insulated switch chamber. This chamber retains heat due to the restricted interface between gas and fluid which is limited to the area of the vent (V) and the transfer tube (T).

2) Reverse current losses maintain the switch at high temperature during operation since the design goal is to retain all the energy in the switch during the drive cycle. This requires the heat capacity of the switch to be matched to the volt-seconds of the transformer which seems to be possible.

3) For switch recovery a measured amount of heat is supplied to chamber (C) by (H_2) which drives most of the liquid from (C) across the switch cooling it quickly.

4) Hot gas liberated in the cooling process is forced out vent (V) by the continuously entering fluid above.

5) Chamber (C) is built with walls of high thermal conductivity so that the gas formed by the (H_2) pulse is quickly condensed after the fluid is forced over the switch. As the gas condenses, fluid is drawn through vent (V) to fill chamber (C) further cooling the switch.

6) In case of a magnet quench through an open switch, the voltage across the switch will rise to a high value. This will overcome the forward voltage drop of (D) and heater (H_3) will drive the liquid from (C) to aid in cooling the switch during quench.

References:

1) A Slow Cycling Flux Pump Using Digital Control, T. F. Droege, J. R. Purcell, and S. T. Wang. 1974 Applied Superconductivity Conference.

2) Mark II Flux Pump Switch Design, S. T. Wang, October 17, 1974.

3) Flux Pump Switch Test, S. T. Wang, November 8, 1974.

TFD:cjm

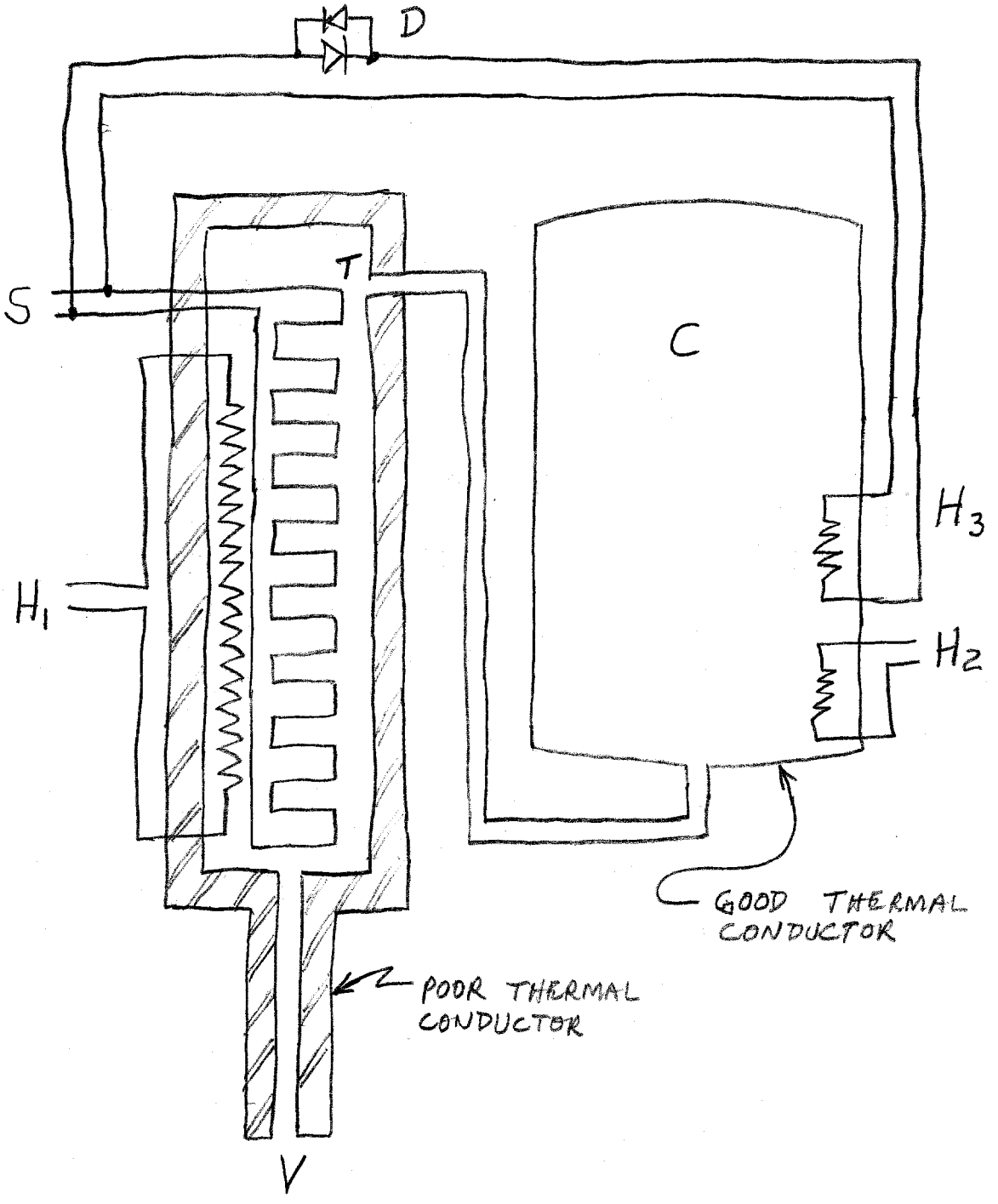
D
T
S
C
H_3
H_1
H_2
GOOD THERMAL CONDUCTOR
POOR THERMAL CONDUCTOR
V

Figure 1